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THE FOOD OF PIKE-PERCH (*LUCIOPERCA LUCIOPERCA* L.) IN LAKE BALATON

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Continuing our previous studies, the food of pike-perch was investigated in Lake Balaton during 1970 and 1971, in order to complete the data available. Now we have a sufficient basis for giving a general idea of the nutritional-ecological role played by the 3—5-year-old specimens representing the majority of the pike-perch population in the lake, as well as for comparison of qualitative and quantitative characteristics of the food for several years back. Such a comparison may lead to valuable conclusions from the point of view of biological processes accompanying the rapid eutrophication of Lake Balaton observed during the recent years. Thus e.g. it is very likely that the decrease in rate of growth of pike-perch as compared to the data obtained some 40 years ago is a result of changes taking place during the last decades in the ecosystem of this shallow lake (UNGER, 1931; BIRÓ, 1970).

This fact can be brought into direct connection with the quantitative insufficiency of the food of pike-perch already interpreted by WOYNÁROVICH (1959). Similar conclusions were drawn by our earlier papers evidencing the low food turnover of pike-perch in Lake Balaton (BIRÓ and ELEK, 1969; BIRÓ, 1969). The slow and uneven growth appearing in consequence of undernourishment during fry stage (BIRÓ, 1972b) which is of critical significance, decisively influences the further development of pike-perch.

SEBESTYÉN (1967) has pointed out that the role of fishes played in the ecosystem is the easiest to approach from the side of nutrition and growth. Accordingly, we attempt to analyze the nutritional biology and role of pike-perch in the lake. Therefore, the present paper was intended at comparing the food of the pike-perch for several years back. Furthermore, an answer was searched for the question of the effect of pike-perch on the food-fish populations of Lake Balaton and of the interpretation of this niche in the ecosystem of the lake.

Material and methods

Our material was collected during 1970 and 1971 partly by means of a special stomach-pump (WOYNÁROVICH, 1958) partly by preparing the internal organs of pike-perches, carried out by fishermen of Fish-farms of

Balaton. We investigated the stomach content of fish of 300—500 g body weight group representing the majority of the annual pike-perch catch. They were fixed in 4 percent formalin separately until the analysis. The stomach contents were analyzed in a Petri dish under stereomicroscope after dilution with water.

Conclusions were drawn for the qualitative change of the food from the seasonal distribution of the species. As possibility offered we determined the degree of digestion of the food (FORTUNATOVA, 1950), then the prey-fishes found in the stomach content were identified in the cases of Cyprinids on the basis of pharyngeal teeth (VÁSÁRHELYI, 1956; BERINKEY, 1966) or sometimes on the structure of scales (DYK, 1956). In the cases of Percids the species could be distinguished depending on the degree of digestion, on the basis of morphology of the operculum, preoperculum, dentale, scales and the stomach, of number of pyloric appendices as well as on the composition of the stomach-content (BERINKEY, 1958; 1966; DYK, 1956; WOYNÁROVICH, 1959).

The quantitative evaluation of the food was carried out on the basis of number of fishes found in the stomach as well as for their measured or reconstructed weights. The stomach contents were divided into six groups according to their weights and the pike-perches were evaluated according to their percentual distribution within those groups. The sum of the original body weight of the food-fishes was estimated, the group averages were calculated with the values of standard deviation and variation coefficients. The food coefficient was calculated from the connection of the actual weight of the stomach-content and the body weight of the pike-perch. For the reconstructions of the weights, the allometric equations of length-weight relationships determined for different fish species were used. The determination of the time of digestion belonging to different temperature ranges was carried out by means of the method of MOLNÁR et al. (1967), allowing us to draw conclusions on the intensity of nutrition. The daily and monthly quantities of the food as well as the daily and monthly rations of food are given using the methods of BAJKOV (1935) and FORTUNATOVA (1950).

The stomach contents of altogether 3347 pike-perches were analyzed during 1970 and 1971.

Results

The quality of food of pike-perch

More or less digested food was found in the stomach of 909 from 1118 pike-perches in 1970, containing 1806 food-fishes, 1472 of which could be identified, whereas 334 could not because of the advanced stage of digestion *(Table I, Fig. 1)*. The food was included the following fish species in a sequence of decreasing frequency: ruff *(Acerina cernua)*, bleak *(Alburnus alburnus)*, pike-perch fry *(Lucioperca lucioperca* L.) and bream *(Abramis brama)*. Altogether 10 species were found in the stomachs, among them the bleak was predominating except in August when the number of fry of the most common Percids (ruff, pike-perch) suddenly increased in the food. The significance of the other species is lower in the food, they represent only 0.3—4.5 percent.

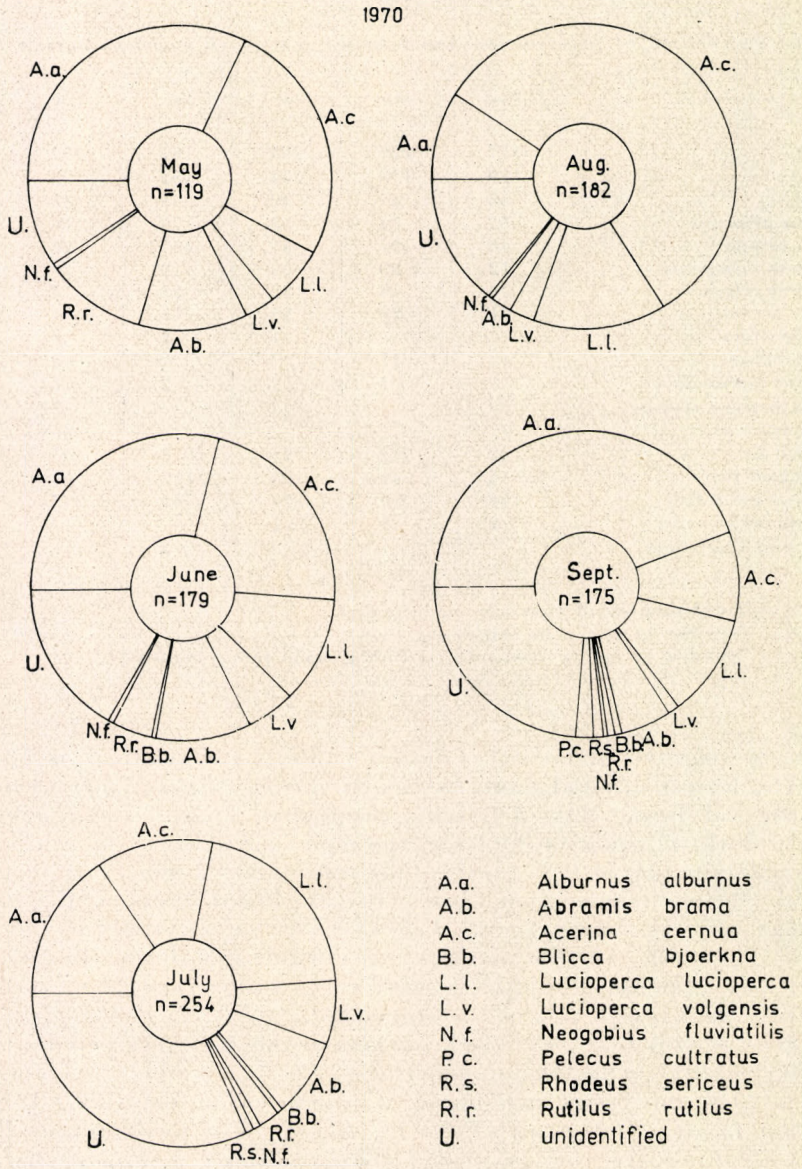

Fig. 1. The food spectrum of pike-perches in Lake Balaton of 300—500 g body weight during 1970. The percentual distribution of food-fishes. n = the number of pike-perch stomachs containing food

TABLE I

The distribution of fish-remains found in the pike-perch stomachs during 1970

	May	June	July	Aug.	Sept.	Total
N	177	226	294	187	234	1118
n	119	179	254	182	175	909
e	58	47	40	5	59	209
Alburnus alburnus	57	74	52	72	116	371
Acerina cernua	46	57	41	447	25	616
Lucioperca lucioperca	12	29	69	112	29	251
Lucioperca volgensis	6	13	22	22	3	66
Abramis brama	21	26	28	18	14	107
Blicca bjoerkna	—	—	1	2	2	5
Rutilus rutilus	19	11	7	—	2	39
Neogobius fluviatilis	1	1	2	2	1	7
Rhodeus sericeus amarus	—	—	2	—	3	5
Pelecus cultratus	—	—	—	—	5	5
Identified fish	162	212	225	673	200	1472
Unidentified fish	16	42	103	110	63	334
Total number of fish	178	254	328	783	263	1806
Dreissena polymorpha	2	2	1	—	—	5
Water-weed fragments	—	1	2	3	1	7

N = Total number of stomachs investigated
n = Number of stomachs containing food
e = Number of empty stomachs (including some pulpy content)

Lucioperca volgensis and roach *(Rutilus rutilus)* are qualified as occasional food. The former occured more frequently during the summer months and the latter did during May. A recently propagated Ponto-Caspian goby *(Neogobius fluviatilis)* could be found in the stomachs in every month, although in a small number of individuals. This species has been living in the lake probably for quite some time (Biró, 1972a). *Blicca bjoerkna*, the bitterling *(Rhodeus sericeus amarus)* and *Pelecus cultratus* occurred in the certain months. The latter may play a more considerable role during autumn. Apart from fishes, sporadically mussels *(Dreissena polymorpha)* and water-weed fragments were also found in the stomachs.

Food was found in 982 (44.1 percent) of the 2229 pike-perches investigated during 1971, while the stomach of 1247 (55.9 percent) was empty. Altogether 1916 prey-fishes were found, we succeeded in identifying 1626 specimens but failed in 290 cases *(Table II, Fig. 2)*. The food contained mainly bleak *(Alburnus alburnus)* and ruff *(Acerina cernua)*, pike-perch fry *(Lucioperca lucioperca)* as well as bream *(Abramis brama)* also occurred. Altogether 13 fish species were found in the stomachs during that year. *Leucaspius delineatus*, eel *(Anguilla anguilla)* and crucian carp *(Carassius carassius)* were first observed in the stomachs, however, because of their low number, they are of less significance. Apart from the main four prey-fishes, the increasing rate of *Blicca bjoerkna* and *Neogobius fluviatilis* was characteristic, whereas the amount of roach was the same as in 1970. *Dreissena* was also observed and several small specimens of *Unio* and *Anodonta* of 1—2 cm shell length were encountered, too.

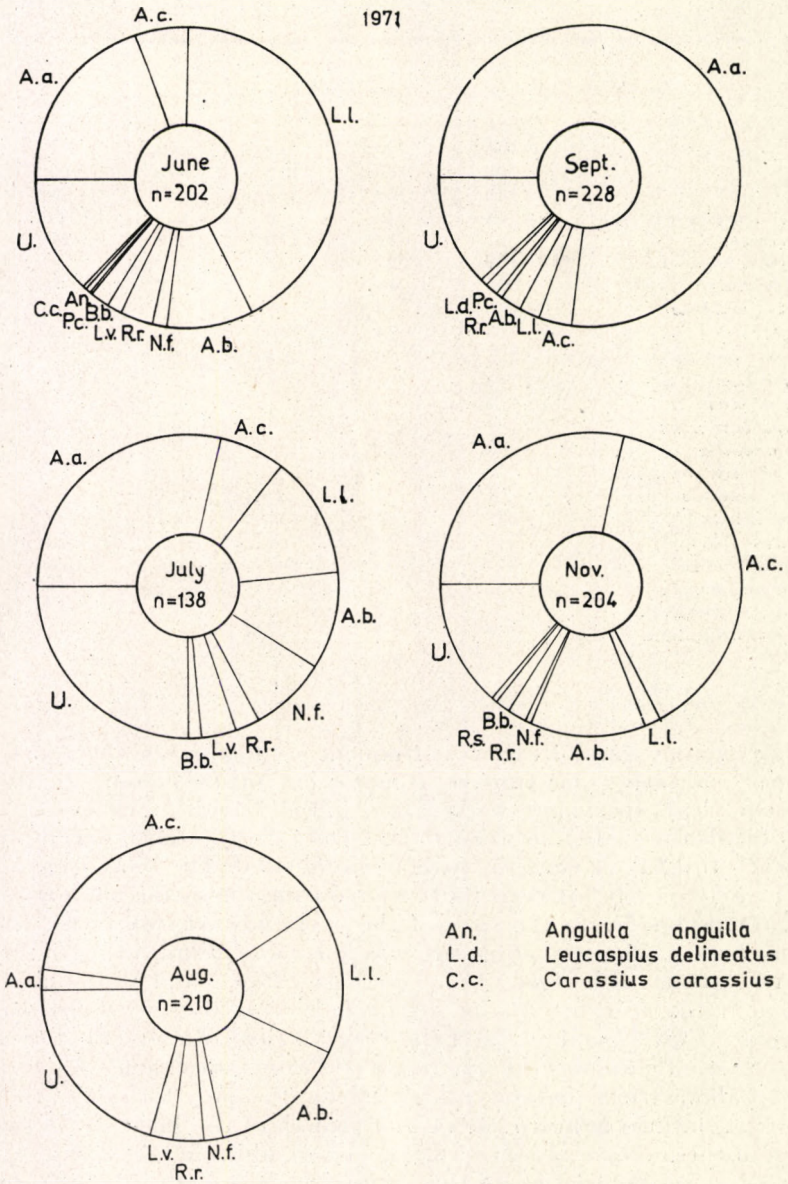

Fig. 2. The food spectrum of pike-perches of 300—500 g body weight in Lake Balaton during 1971. (Explanation as in *Fig. 1)*

TABLE II

The distribution of fish-remains found in the pike-perch stomachs during 1971

	June	July	Aug.	Sept.	Nov.	Total
N	451	400	618	468	292	2 229
n	202	138	210	228	204	982
e	249	262	408	240	88	1 247
Alburnus alburnus	74	48	6	444	144	716
Acerina cernua	21	12	116	20	196	365
Lucioperca lucioperca	159	22	48	12	8	249
Abramis brama	35	18	44	12	60	169
Neogobius fluviatilis	6	14	6	4	2	32
Rutilus rutilus	13	4	10	—	10	37
Lucioperca volgensis	7	6	8	—	—	21
Blicca björkna	8	2	—	—	8	18
Pelecus cultratus	1	—	—	8	—	9
Leucaspius delineatus	—	—	—	4	—	4
Anguilla anguilla	3	—	—	—	—	3
Rhodeus sericeus amarus	—	—	—	—	2	2
Carassius carassius	1	—	—	—	—	1
Identified fish	328	126	238	504	430	1 626
Unidentified fish	46	42	60	72	70	290
Total number of fish	374	168	298	576	500	1 916
Dreissena polymorpha	3	—	2	—	—	5
Unio and *Anodonta* sp.	—	2	2	—	—	4
Water-weed fragments	1	4	—	—	6	11

The size of prey-fish

The average sizes of the most frequent six food species changed parallel with the qualitative-quantitative composition of the food. Mainly of the 5.5—7 cm bleak specimens were eaten *(Figs 3* and *4)*, whereas the body length of ruffs fluctuated between 4 and 6 cm *(Figs 5* and *6)* except in August 1970, when the 3.5—4 cm specimens predominated. The body length of pike-perch fry were mostly between 7 and 8 cm during the spring and early summer season, corresponding to the sizes of the overwintered specimens. In August 1970 and June 1971 the average size was 2.5—5.5 cm indicating an increasing role of fry masses in the food of pike-perches *(Figs 7* and *8)*. Similar changes appeared in the size distribution of *Lucioperca volgensis* *(Figs 9* and *10)*, the bream *(Figs 11* and *12)* and the roach *(Figs 13* and *14)*. The maximal length of prey-fishes was 14 cm (several *Pelecus* specimens).

The allometric equations calculated for the prey-fishes i.e. the length-weight relationships indicate the rate of growth of the linear body size in the function of the increase of body weight, and in addition, allow us to carry out a more exact reconstruction of the original body weight at the quantitative evaluation of the food. The calculated equations for the different fish species are as follows:

Bleak: $\log W = -4.6731 + 2.8865 \cdot \log L$
Ruff: $\log W = -4.8993 + 3.0855 \cdot \log L$
Pike-perch fry: $\log W = -4.6088 + 2.8379 \cdot \log L$
Bream: $\log W = -4.8146 + 3.0644 \cdot \log L$
Roach: $\log W = -4.9698 + 3.1441 \cdot \log L$
Goby: $\log W = -5.0386 + 3.1398 \cdot \log L$

where W is the body weight in grams and L is the standard length in mm.

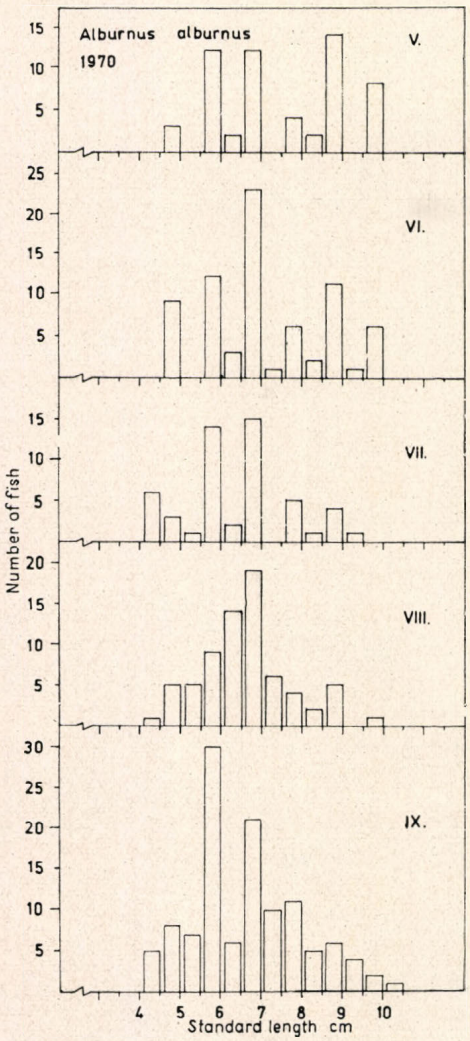

Fig. 3. The size distribution of bleak *(Alburnus alburnus)* in the food of pike-perch in 1970

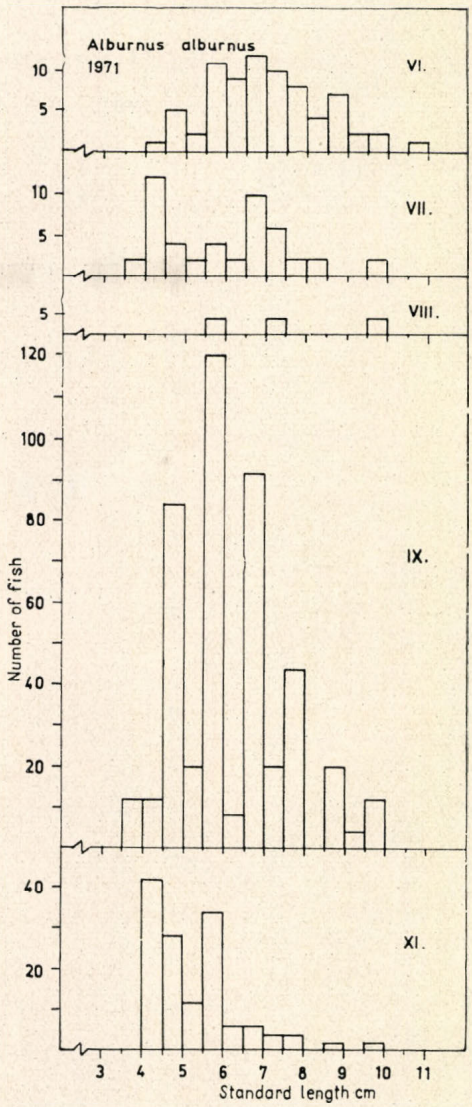

Fig. 4. The size distribution of bleak *(Alburnus alburnus)* in the food of pike-perch in 1971

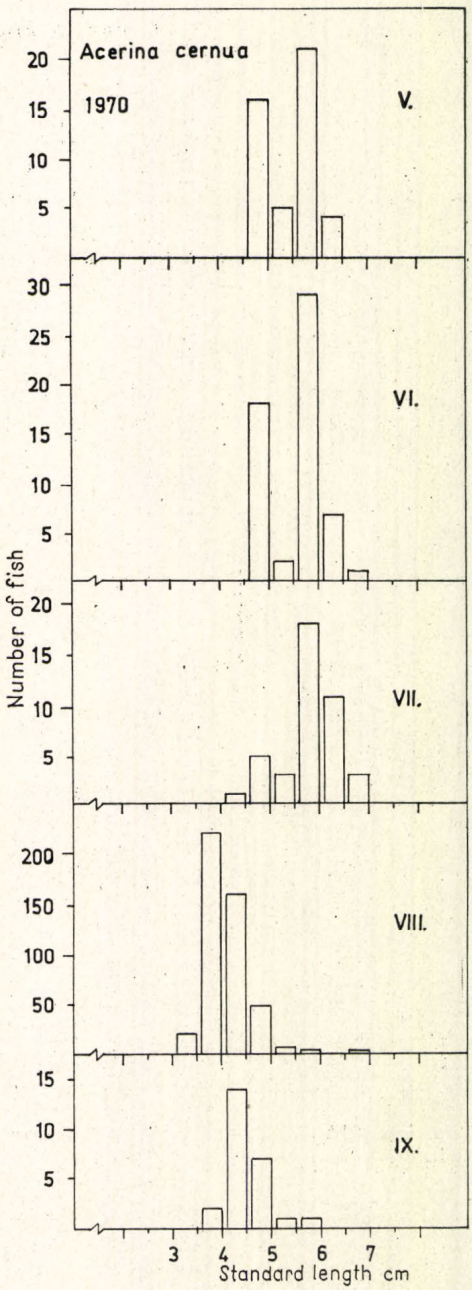

Fig. 5. The size distribution of ruff *(Acerina cernua)* in the food of pike-perch in 1970

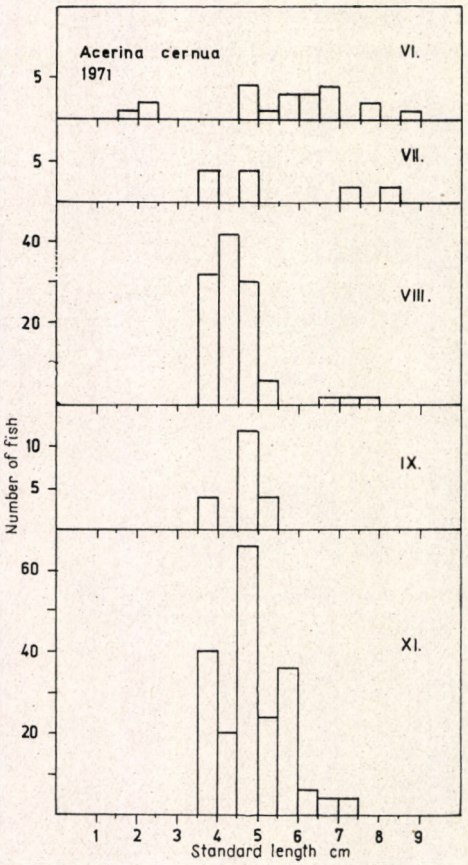

Fig. 6. The size distribution of ruff *(Acerina cernua)* in the food of pike-perch in 1971

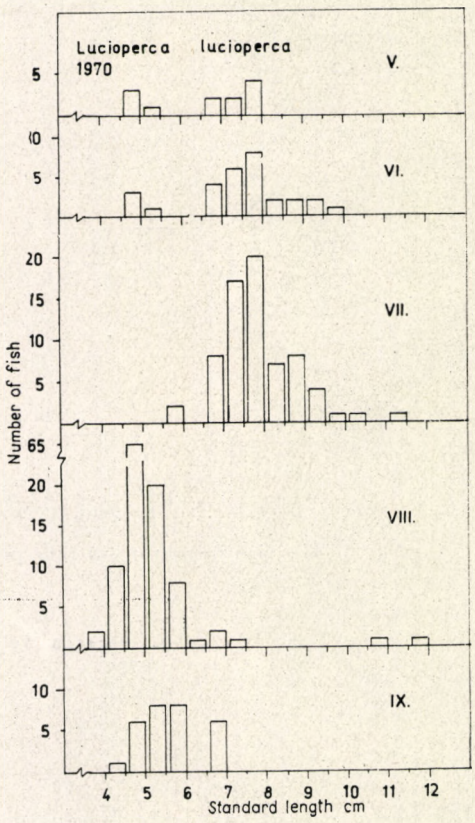

Fig. 7. The size distribution of pike-perch fry *(Lucioperca lucioperca)* in the food of older pike-perches during different months of 1970

The number of consumed prey-fishes

The majority of the pike-perch stomachs (56 percent) contained 1—2 fish in 1970, whereas those containing 2—3 fish were less frequent. Only in August could be observed an abrupt increase of prey-fishes maximally up to 15 per stomach because of the small sizes of the fry *(Fig. 15)*. In June 1971 the maximal number of fish consumed by one pike-perch was 28 and in November was 25 *(Fig. 16)*. According to our experience, the number of consumed fish depends on the mass appearance of the fry of a species of suitable size. The population density of food-fishes and their occurrence in the stomachs of pike-perches are in direct connection, indicating obviously the seasonal character of nutrition of pike-perches in Lake Balaton.

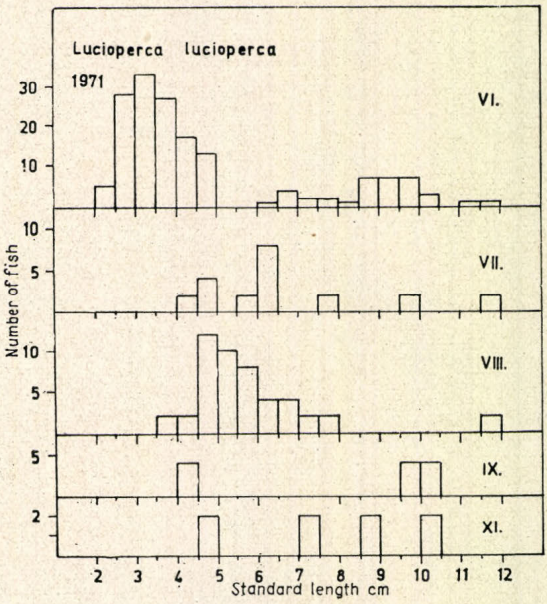

Fig. 8. The size histogram of pike-perch fry *(Lucioperca lucioperca)* in 1971

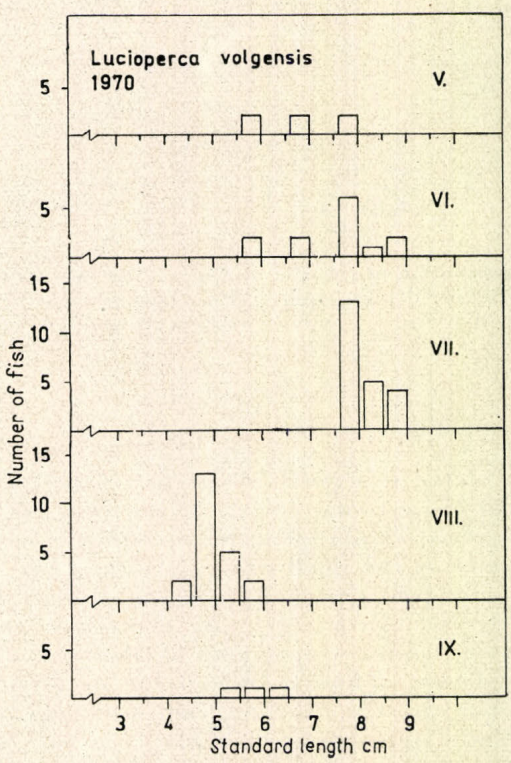

Fig. 9. The size distribution of *Lucioperca volgensis* in the stomach-content of pike-perches in 1970

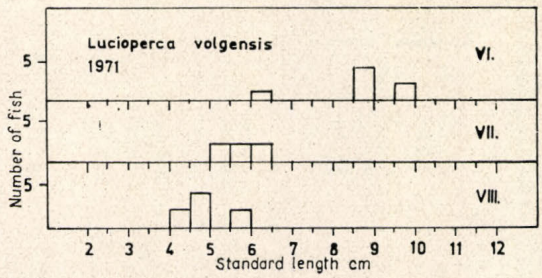

Fig. 10. The change of sizes of *Lucioperca volgensis* in the stomach-content of pike-perches during 1971

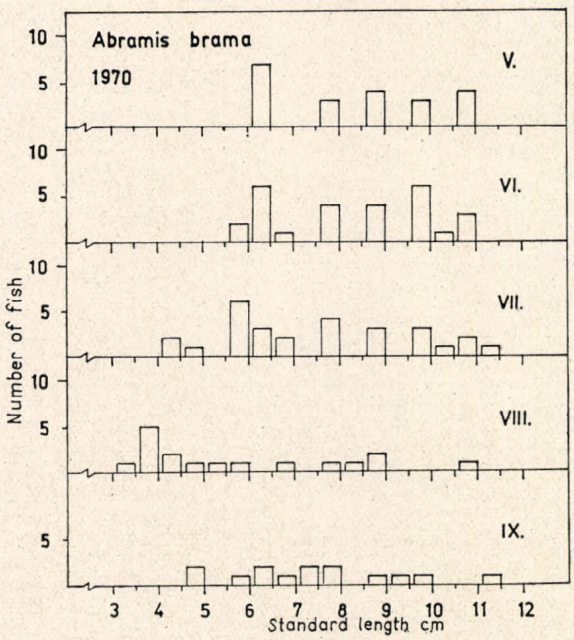

Fig. 11. The change of sizes of bream *(Abramis brama)* in the food of pike-perches during different months in 1970

The observed weight of stomach-content

In 1970 the average food per pike-perch was 6.3 g, and the average per one stomach containing food was 7.8 g *(Fig. 17)*. In 1971 these data were 4 and 8.3 g, respectively *(Fig. 18)*. Those data give only some orientation, since they are not in connection with the digestion rate.

The distribution of the number of individuals as well as the percentage of pike-perches within the stomach-content weight-groups showed a pattern similar to the distribution of the number of food-fishes: the mass of stomach-contents was 0.1—5.0 g in nearly 46 percent, 5.1—10 g in 30 percent, and larger weights of stomach-contents were found only in a less number of pike-

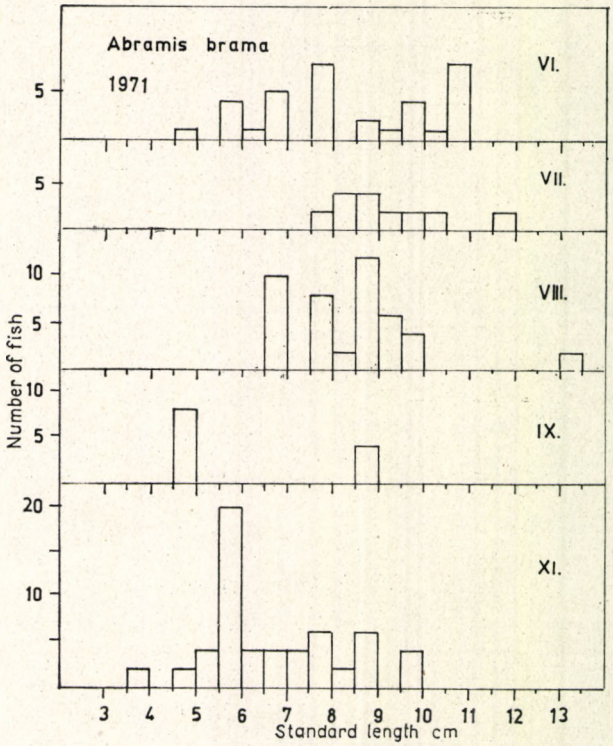

Fig. 12. The change of sizes of bream *(Abramis brama)* in the food of pike-perches during different months in 1971

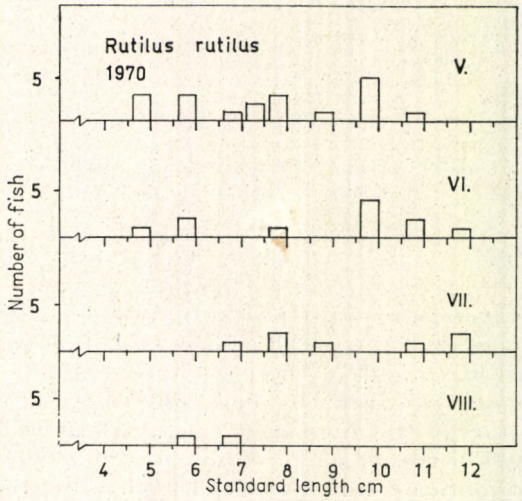

Fig. 13. The size distribution of roach *(Rutilus rutilus)* in the food of pike-perches during 1970

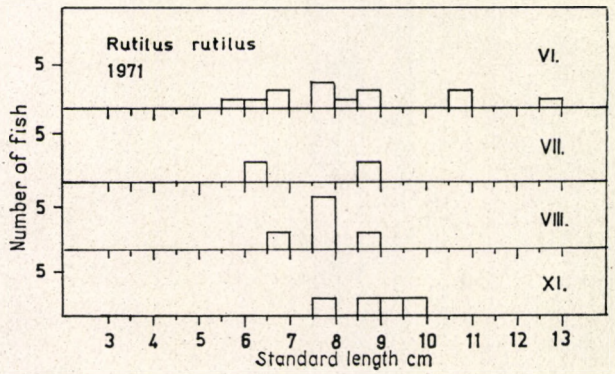

Fig. 14. The size distribution of roach *(Rutilus rutilus)* in the food of pike-perches during different months in 1971

perches *(Figs. 19* and *20)*. The distribution of the number of individuals within the stomach-content weight-groups, the averages of the groups, the numerical values of deviation and variation coefficient are near to each other showing a similar trend during the different months. The values in 1971 were rather the same, however, the number of pike-perches eating 10—20 g increased. Nevertheless, the deviation from the average in every weight-group of stomach-contents was a much lower value as compared to that of the previous year. With the increase of actual weight of the stomach-contents the number of pike-perches decreases. Only a few pike-perch may have opportunity to consume an amount of fishes reaching 10 percent of the average body weight for a prolonged time because of the seasonal changes of the population density of the food-fishes.

Digestion rate and feeding intensity

The increase of the average temperature of the water results in a more rapid digestion, accompanied by an increase of the intensity of nutrition and more frequently repeated incorporation of food *(Table III)*. The rate of digestion (the time necessary for the emptying of the stomach) and the average, monthly number of food incorporations are closely, significantly correlated ($P < 0.001$).

Food consumption

The food consumption estimated on the basis of method of BAJKOV (1935) and FORTUNATOVA (1950), related to the rate of digestion, indicates a low level of food turnover in the weight group investigated. The daily and monthly food consumption depending on the temperature and rate of digestion are low, in 1970 they amounted to 3.2—3.9 and 52—61.4 g, respectively, in average. The amount of food consumed during the period of investigations was 307 and 260 g per one pike-perch *(Fig. 21)*. An increased food consumption was observed during June and August, whereas during May, July and September food consumption decreased. The results obtained during 1971 strongly differ from those of the previous year in so far as the daily and monthly food

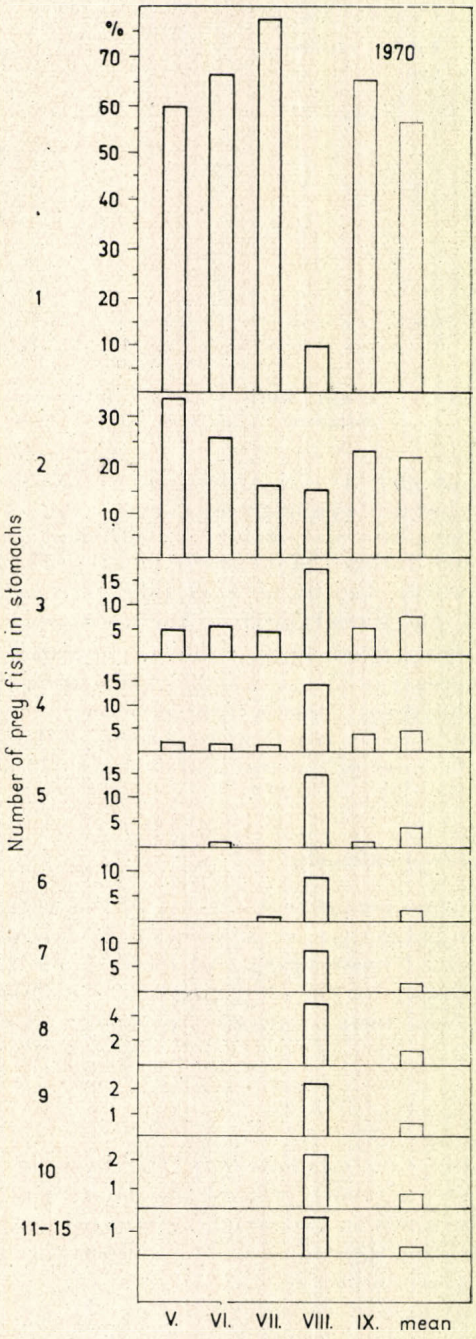

Fig. 15. The percentual distribution of pike-perches of 300—500 g body weight according to the number of fish-remains found in their stomachs during different months in 1970

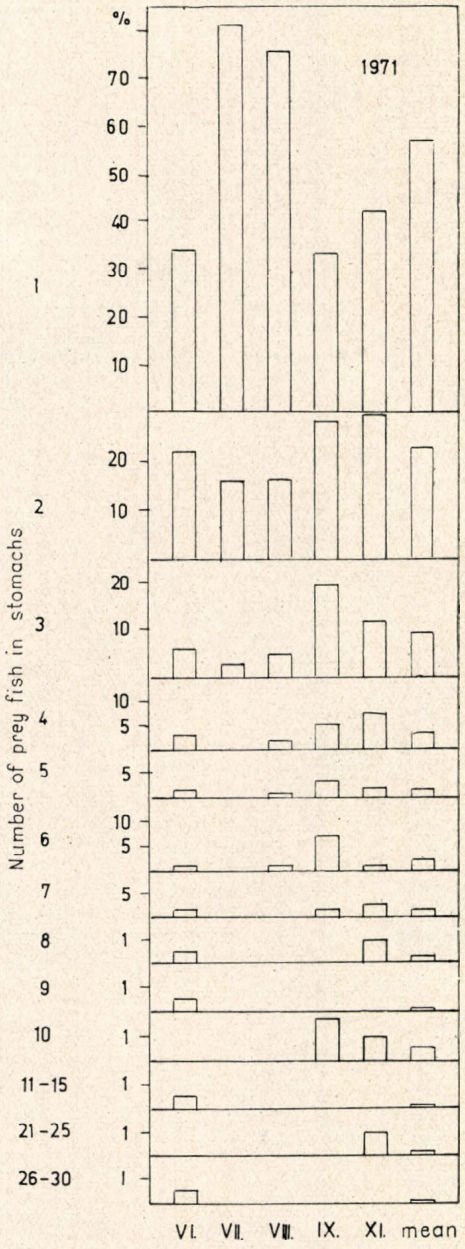

Fig. 16. The percentual distribution of pike-perches of 300—500 g body weight according to the number of fish-remains found in their stomachs during different months in 1971

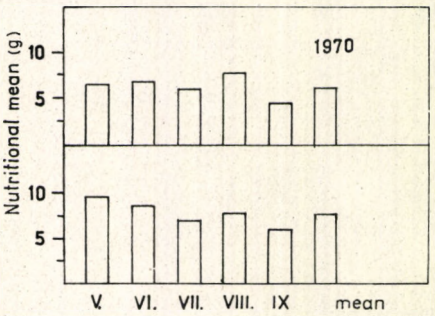

Fig. 17. The amount of food per one pike-perch stomach (upper part) and per one stomach containing food (lower part, in g) during 1970

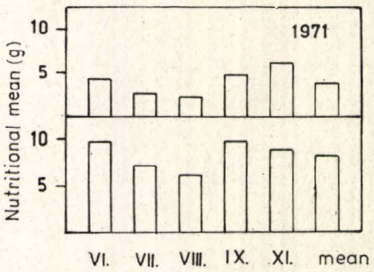

Fig. 18. The amount of food in g per one pike-perch stomach (upper part) and per one food-containing stomach (lower part) in 1971

TABLE III

The rate of digestion depending on the monthly average temperature of Lake Balaton as well as the average frequency of food uptakes during different months

Year	Month	T	V	y	i
1970	May	15.5	2.75	66.2	11.2
	June	20.7	1.85	44.5	16.2
	July	21.1	1.79	43.0	17.3
	August	22.7	1.63	39.2	19.0
	September	18.4	2.17	52.3	13.8
1971	June	20.3	1.90	45.7	15.8
	July	21.9	1.72	41.2	18.0
	August	23.7	1.54	36.9	19.5
	September	15.8	2.69	64.6	11.5
	November	8.1	6.74	161.8	4.6

T = average water temperature (°C); V = time of digestion in days; y = time of digestion in hours (= duration of emptying of the stomach); i = number of food uptakes per month. The data are calculated on the basis of equation describing the logarithmic relationship of temperature and digestion according to MOLNÁR et al. (1967):

$$y = -1.3759 \cdot \log T + 3.4589$$

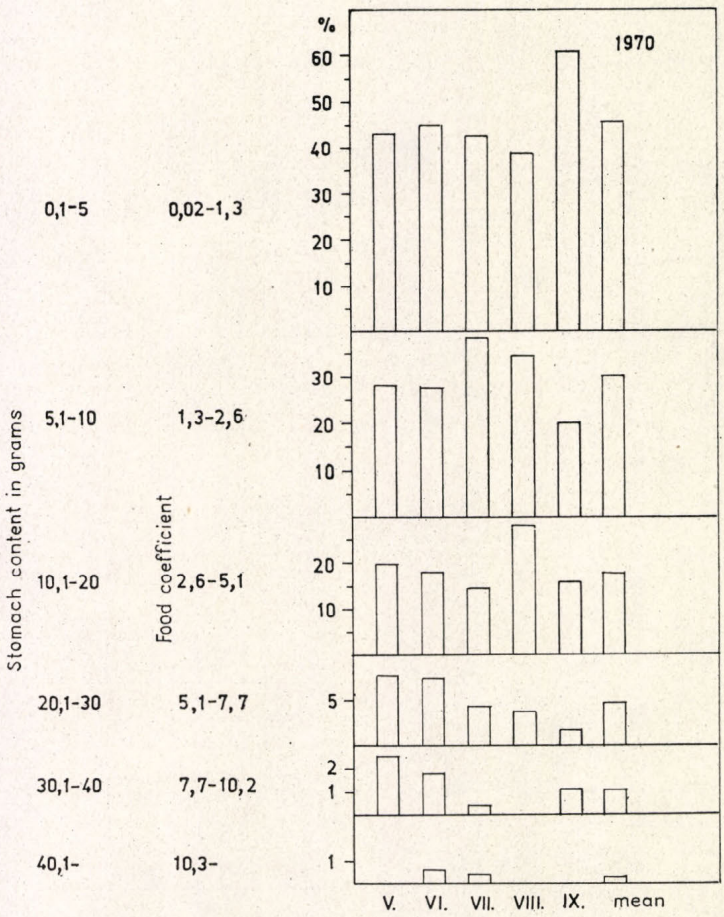

Fig. 19. The percentual distribution of pike-perches of 300—500 g body weight according to the total weight of the stomach-contents as well as to the value of food-coefficient in 1970

consumptions displayed an almost continuous decrease from June till November *(Fig. 22)*. The daily consumption reached 2.2—3.6 g, the monthly 28.7—56.5 g, thus, the amount of food consumed by one pike-perch during the five months of the investigations can be estimated as 144—283 g. There is also a close, significant correlation between the temperature of water and the amount of food consumed. The reason of decreased food consumption observed in 1971 is not known, presumably some environmental changes were responsible.

Daily and monthly rations

The daily and monthly food rations are low. The evaluations by the two methods resulted in 0.82—0.99 percent and 13.34—15.74 percent, respectively for 1970. Their dependence on the temperature is highly significant. Nearly

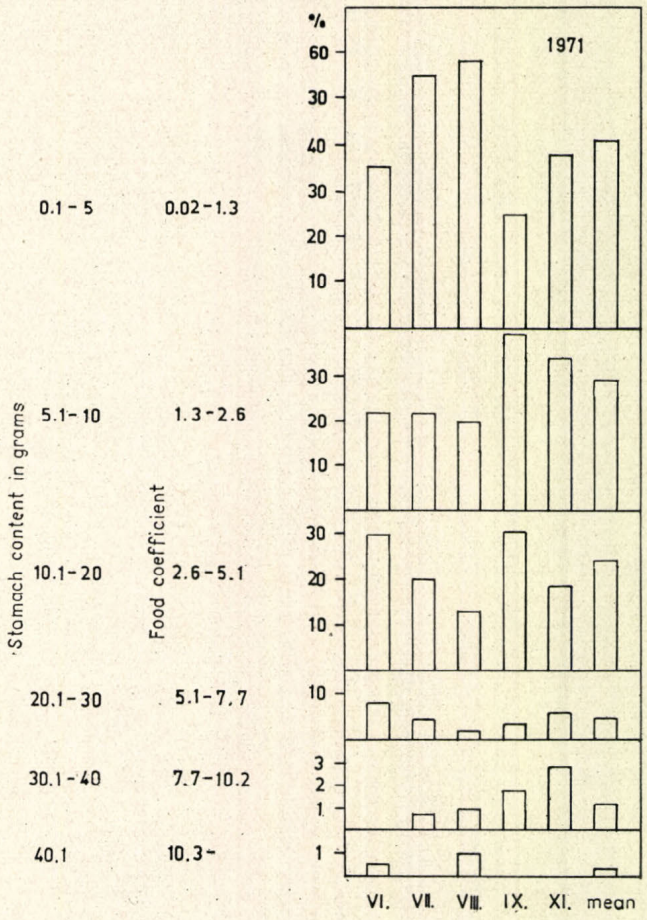

Fig. 20. The percentual distribution of pike-perches of 300—500 g body weight according to the total weight of the stomach-contents as well as to the values of food-coefficient in 1971

identical but low values were calculated during May and September, July showed intermediary values, then higher but almost identical ones were found in July and August *(Fig. 23)*. During the five months of investigations in 1970, the amount of food consumed by one pike-perch reached only 67—79 percent of the average body weight.

In 1971 the decreasing tendency of daily and monthly food rations were characteristic similarly to the food consumption. They were 0.4—0.9 percent daily and 7.35—14.49 percent monthly in average, and obviously are extremely low, since one pike-perch could consume only 37—72 percent of its own body weight during the period of June—November (except October) *(Fig. 24)*. The estimated food consumption and its rate to the average body weight evidence that pike-perches of 300—500 g weight group representing the majority

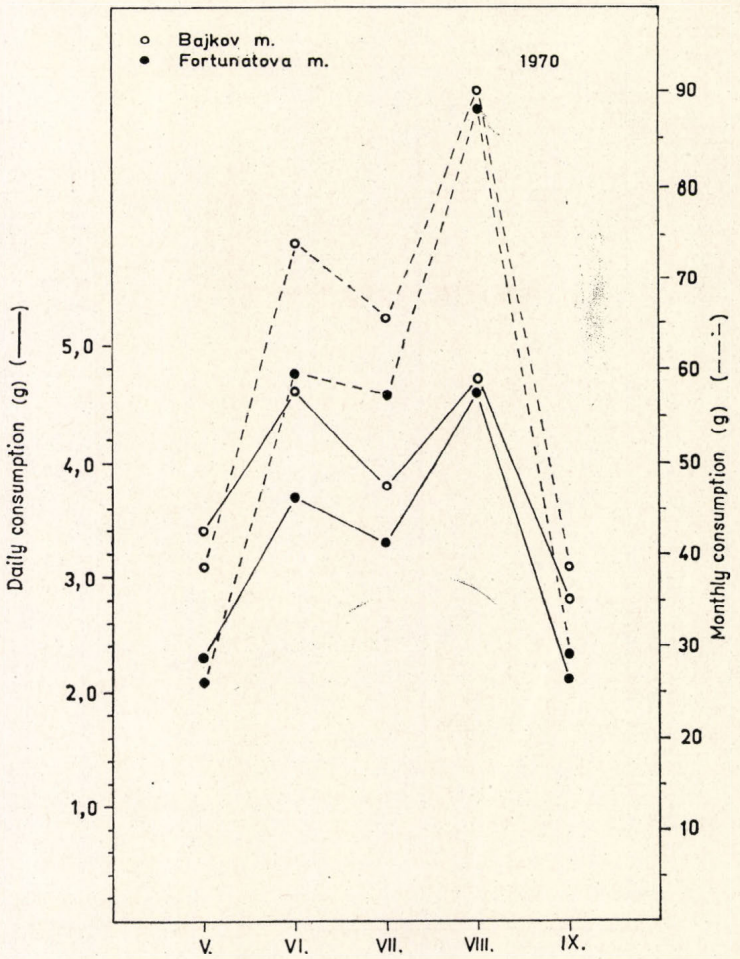

Fig. 21. The daily and monthly food consumption of a pike-perch of 390 g average body weight, in g during 1970, calculated on the basis of rate of digestion using the method of BAJKOV (1935) and FORTUNATOVA (1950)

of the catcheable portion of the population in the lake are underfed. This part of the pike-perch stock is usually represented by 3—4 or ofter 5-year-old specimens.

Discussion

Summing up the results of a series of investigations spread over several years, one can establish that the food of pike-perch in Lake Balaton is reprezented of 10—15 species of fish varying according to season. In the stomachs 2—3 species appear in masses. Among the latter the significance of bleak gradually increased against ruff forming an almost decisive majority in the food during the former years (WOYNÁROVICH, 1959). Occasionally extensive cannibalism

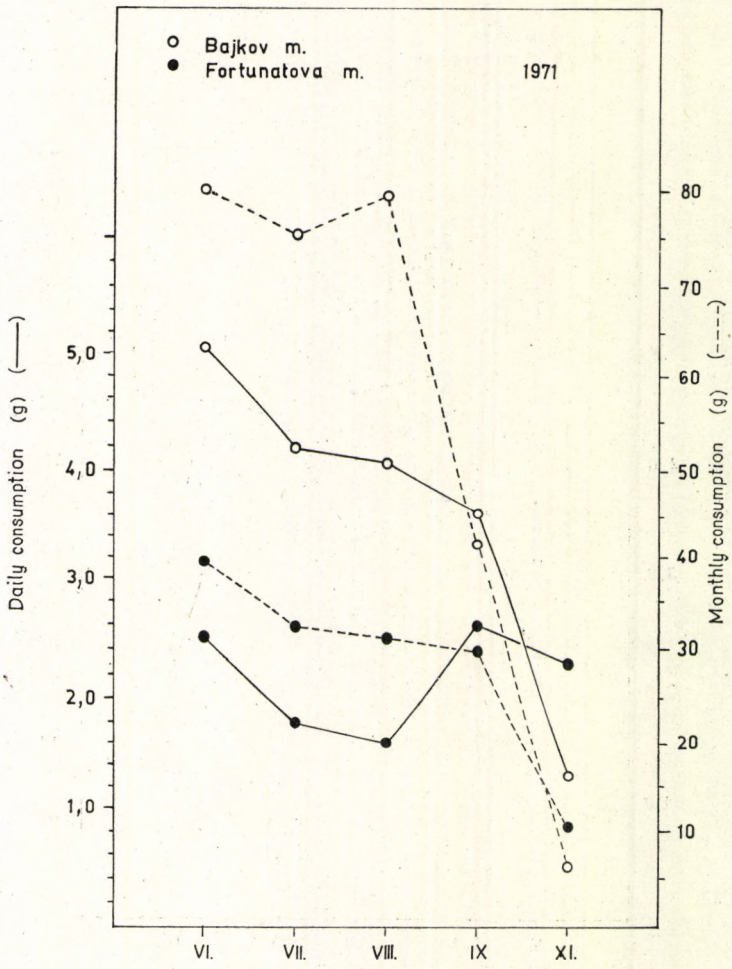

Fig. 22. The daily and monthly food consumption of a pike-perch of 390 g average body weight, in g during 1971, calculated on the basis of rate of digestion using the method of BAJKOV (1935) and FORTUNATOVA (1950)

had been observed among the pike-perches belonging to the size groups investigated, the reason of which can be searched in the decrease of the population density of fish species living near the bottom and the pike-perch fry living in the same region are available for the older predators. The increase of the food-fish species also indicates that the population density of the food-fishes decreased and the pike-perches take food from the littoral zone, the upper and deeper areas of the open water and from the areas of water-weed, too. The appearance of five new species in the food cannot be neglected. They are: *Leucaspius delineatus*, *Tinca tinca*, *Carassius carassius*, *Anguilla anguilla* and *Neogobius fluviatilis*. The last one abruptly propagated in Lake Balaton in 1970 (BIRÓ, 1972a) and gradually became significant for pike-perch. The remains of mussels and water-weed fragments frequently found in the stomachs

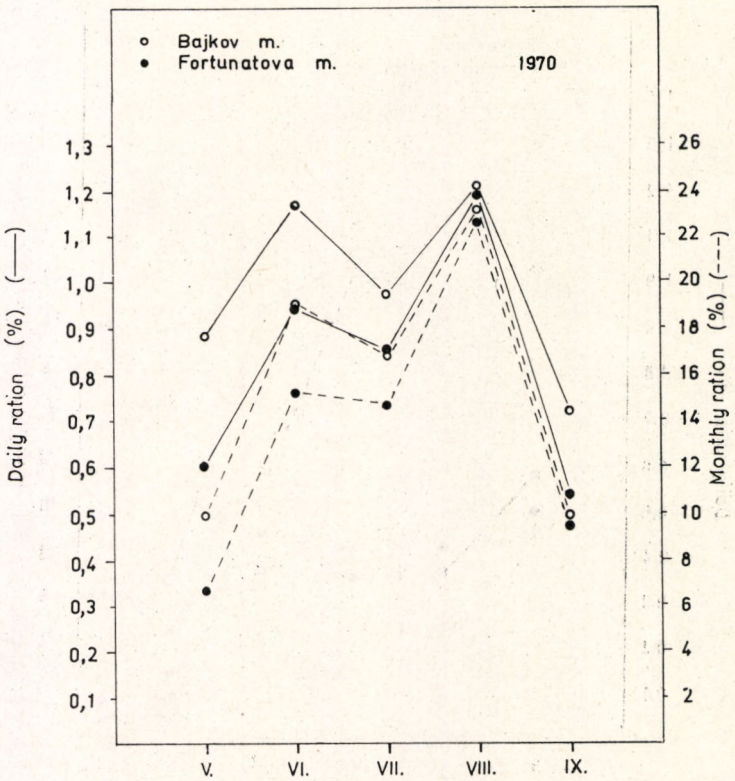

Fig. 23. The daily and monthly rates of food of a pike-perch of 390 g average body weight during different months in 1970

could passively have got in during predation. The increase of the number of Cyprinids living in the littoral zone and near the surface in the food as well as the yearly changing water-level can be brought into close relation with each other.

Surveying the papers analyzing the food of pike-perch in Lake Balaton, one can see that the highest frequency was reached by the ruff *(Acerina cernua)* and the pike-perch fry *(Lucioperca lucioperca)*, furthermore the rates of bleak *(Alburnus alburnus)* as well as sichel *(Pelecus cultratus)* were also considerable (LUKÁCS, 1932a; 1932b; ENTZ and LUKACSOVICS, 1957; WOYNÁROVICH, 1959). The quality of the food strongly changed after 1965, since beside the Percids the bleak became of an ever increasing significance (BIRÓ and ELEK, 1969) further supported now by the investigations of the years 1970—71.

The seasonal changes of the composition of food are induced first of all by the availability and density of fry of the food-fishes. Sometimes extensive cannibalism can be observed among the pike-perches of Lake Balaton which may indicate the absence of other forms of food, and the high mortality rate observed among the fry in the first summer (BIRÓ, 1972b) can be some kind of an explanation to it. The pike-perch population maintains a self-regulation

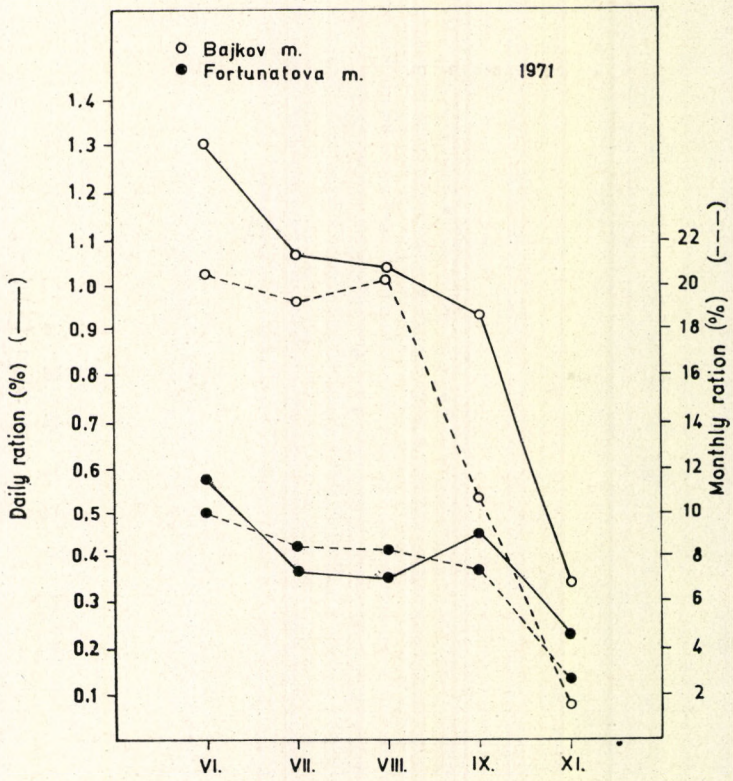

Fig. 24. The daily and monthly rates of food of a pike-perch of 390 g average body weight during different months in 1971

by consuming their own fry and regulates the other prey-fish populations to a variable extent by selecting the groups of sizes preferred (FORTUNATOVA, 1957). The niche of pike-perch within the ecosystem of Lake Balaton can be interpreted principally through this effect.

The change in the rates of pike-perches with empty stomach and with food must be analyzed with reservations, since the actually empty stomach in itself does not wholly indicate an insufficiency of the food. It is more likely a physiological necessity, since the digestion depends on the temperature of the water and the latter determines the feeding intensity even in the case of good food supply. LUKÁCS (1932a) found the stomach to be empty in 27 percent of the animals, ENTZ and LUKACSOVICS (1957) observed the same in 22—75 percent, whereas WOYNÁROVICH (1959) reported on a yearly average of 37 percent. Extensively variable rates were observed between 1965 and 1971 by us, the rate of pike-perches with actually empty stomach varied between 19 and 59 percent (c.f. BIRÓ and ELEK, 1969). WOYNÁROVICH (1959) concluded on the basis of the high number of empty stomachs that pike-perches starve and if we neglect the physiological significance of the empty stomach, even our data indicate the insufficiency of the food to a greater extent than a decade before.

Apart from the quality of the food, the quantitative comparisons revealed a more disadvantageous direction of changes. The daily food consumed depending on the rate of digestion reaches as a rule 1 percent of the body weight of the pike-perch, and what is more in 1971 it was below this level. The daily food amount of pike-perch varied between 1—4 g in the majority of cases, representing an insufficient quantity. The slow growth is a consequence of the undernourishment, observed both in fry and in older fish (BIRÓ, 1970; 1972b).

The investigations on young pike-perches of 0.19—13.3 g body weight (POLTAVCHUK, 1965) revealed a food coefficient 3.2—3.9 (average: 3.5) remaining unchanged between 11 and 26° C. ZAMOJSKA (cit. BACKIEL, 1971) investigated the age group 0+ kept in cages in temperated fish-ponds of 23—28° C and found a coefficient of 2.8—5.9 without temperature dependence. IVANOVA (1968) also studied pike-perches using the method of FORTUNATOVA and found the following values: 1.4 at age groups 2+ and 4+; 5.1 at age groups 5+ and 7+. The value of the food coefficient changes with the age however, it is also bears relation with the body size (BACKIEL, 1971). In our investigations the daily amount of food was 1—4 g. The time of digestion of that amount depends also on the quality of the food (WINDELL, 1966; 1967; POPOVA, 1967; BARRINGTON, 1957; HUNT, 1960).

Considering either the daily or the monthly values of food consumed by the pike-perch of Lake Balaton, one has to conclude that they are underfed. Comparing this fact with the eutrophication of the lake, it is difficult to explain why the food of pike-perches has decreased since the investigations of WOYNÁROVICH (1959). The explanation lies in the drop of the populations of food-fishes already described (BIRÓ and ELEK, 1969). The insufficiency of miscellaneous food is indicated by the second-third place occupied by the pike-perch fry in the stomach-contens of older pike-perches. Thus, the food-competition becomes sometimes of high significance. Competition for the pike-perch fry with other fish-species become sharper in the regions of 100—300 m width near the shore. On the basis of all these considerations, it is justifiable to assume that the density of food diminished owing to pollution and toxic substances further decreases and an increasing interspecific competition is at issue. Our observations regarding the food of pike-perches support the earlier findings related to the growth of this species (BIRÓ, 1970).

Summary

The stomach-contents of 3347 pike-perches of 300—500 g body weight were analyzed during 1970 and 1971. The food is composed of 10 fish species to a seasonally variable extent. Among them only 2—3 play a decisive role owing to their frequency of occurrence. They are the bleak *(Alburnus alburnus)*, the ruff *(Acerina cernua)* and the pike-perch fry *(Lucioperca lucioperca)*. When the fry appear, the food consists almost exclusively of them. The most commonly fed size-groups of each food-fish species can clearly be determined from the sizes of fishes found in the stomachs.

The stomachs of pike-perches investigated as a rule contained 1—2 fish, apart from those having an actually empty stomach. The number of fish consumed depends among others on the mass appearance of fry of suitable sizes.

The value of food coefficient in the majority of cases was 0.02—2.6 (76 percent), and values between 2.6 and 5.1 were encountered in about 17 percent of the predators. The food consumption is insufficient, since the daily amount of food is only 1—4 g. Accordingly, also the food rate is very low, hardly reaching the value of 1 percent of body weight during both years.

Five new species of fish were found in the food of the pike-perch of Lake Balaton which were not consumed formerly. Among them the *Neogobius fluviatilis* may later achieve greater significance because of its mass appearance and propagation observed during recent years.

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A FOGASSÜLLŐ *(LUCIOPERCA LUCIOPERCA* L.) TÁPLÁLÉKA A BALATONBAN

Biró Péter

Összefoglalás

1970—71 években 3347 db, 300—500 g súlyú fogassüllő gyomortartalmát analizáltuk. A táplálékot szezonálisan változó mértékben kb. 10 halfaj alkotja, ezek közül 2—3 fajnak van gyakorisága alapján döntő jelentősége. Ezek a küsz *(Alburnus alburnus)* vágódurbincs *(Acerina cernua)* és a fogassüllő-ivadék *(Lucioperca lucioperca).* Az ivadékhalak megjelenésével a táplálék csaknem kizárólag ezekből áll. A gyomrokban talált táplálékhalak méreteiből világosan megállapítható, hogy melyek a legáltalánosabban fogyasztott méretcsoportok a különböző fajoknál.

A tanulmányozott méretcsoportú süllők gyomra általában 1—2 db halat tartalmazott, leszámítva a pillanatnyilag üres gyomrú halakat. Az elfogyasztott halak száma — többek között — egy-egy faj alkalmas méretű ivadékainak tömeges megjelenésétől függ. A táplálék együttható értéke az esetek többségénél 0,02—2,6 közötti (kb. 76%-nál), 2,6—5,1 közötti értéket a süllőknek kb. 17%-ánál találtunk. A táplálékfogyasztás nem kielégítő mértékű, mert a megevett halak tömege naponta 1—4 g. Ennek megfelelően a táplálék arány is igen alacsony, amelynek napi értéke mindkét vizsgálati évben alig érte el a ragadozó testsúlyának 1%-át.

A balatoni fogassüllő táplálékából 5 újabb halfaj került elő, amelyeket korábban nem fogyasztott, s ezek közül nagyobb jelentőségűvé, az utóbbi években észlelt tömeges elszaporodása miatt a *Neogobius fluviatilis* válhat.